

**Second Five-Year Review Report**

**for**

**Solid State Circuits  
Republic  
Greene County, Missouri**


**September 2002**

**PREPARED BY:**

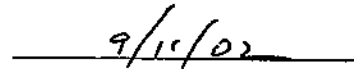
**Missouri Department of Natural Resources  
Hazardous Waste Program  
Jefferson City, Missouri**

Approved by:

Date:



Betty Wyse  
Acting Director  
Hazardous Waste Program





UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION VII  
901 NORTH 5TH STREET  
KANSAS CITY, KANSAS 66101

SEP 20 2002


Betty Wyse  
Acting Director  
Hazardous Waste Program  
Missouri Department of Natural Resources  
P.O. Box 176  
Jefferson City, Missouri 65102-0176

Dear Ms. Wyse:

The Environmental Protection Agency (EPA) has reviewed the "Second Five-Year Review Report for Solid State Circuits, Republic, Greene County, Missouri" prepared by the Missouri Department of Natural Resources (MDNR). The EPA concurs with the findings and protectiveness statement presented in the report. Specifically, the EPA concurs with the MDNR that the remedial activities completed and the subsequent operation of the groundwater extraction and treatment system by the Missouri Remedial Action Corporation, Inc., provide effective protection of human health, welfare, and the environment and comply with the Record of Decision for the site.

Since hazardous substances, pollutants, or contaminants remain at the site at levels which will not allow for unlimited use or restricted exposure, the EPA and/or the MDNR will conduct additional five-year reviews in the future for the Solid State Circuits site.

Sincerely,

  
Michael J. Sanderson  
Director  
Superfund Division

cc: Candice McGhee, MDNR Superfund Unit

## Five-Year Review Report

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- Comments received from Support Agencies and/or the Community

## **List of Acronyms**

AOC	Administrative Order on Consent
Agencies	MDNR & EPA combined
AM	Action Memorandum
AR	Administrative Record
ARARs	Applicable or Relevant and Appropriate Requirements
AS	Availability Session
BlS	Below surface grade
COCs	Contaminants of Concern
CD/SOW	Consent Decree/Statement of Work
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CP	Contingency Plan
CW	Republic's municipal well
DBR	Deep Bedrock
department	Missouri Department of Natural Resources
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Difference
FCOR	Final Close Out Report
GMMP	Groundwater Monitoring and Management Plan
MCLs	Maximum Contaminant Levels
MCLGs	Maximum Contaminant Level Goals
MRAC	Missouri Remedial Action Corporation
NCP	National Contingency Plan
NPL	National Priorities List
NSOC	National Synthetic Organic Chemical Survey
O&M	Operation and Maintenance
PCE	Tetrachloroethylene
PCOR	Preliminary Close Out Report

### **List of Acronyms Cont'd**

PM	Project Manager
POTW	Publicly Owned Treatment Works
ppb	Parts per billion

PRP(s)	Potentially Responsible Party(ies)
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RA	Remedial Action
RAA	Rolling Annual Average
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/ Remedial Action
RI/FS	Remedial Investigation/ Feasibility Study
ROD	Record of Decision
SBR	Shallow Bedrock
SDWA	Safe Drinking Water Act
SOW	Statement of Work
SSC	Solid State Circuits
TBC(s)	To Be Considered(s)
TCE	Trichloroethylene
TCL	Target Compound List
UFSB	Unconsolidated/Fractured Shallow Bedrock
VOC(s)	Volatile Organic Compound(s)

## **Executive Summary**

The remedy for the Solid State Circuits (SSC) Site in Republic, Missouri, only addresses the contamination of the groundwater aquifers. Previous removal response actions had dealt with onsite contaminated soils. The onsite contaminated soils were the source of the continuing contamination. A pump and treat system was the chosen remedy documented in the Record of Decision (ROD). The remedy included the extraction of the contaminated groundwater, onsite treatment of the groundwater by air strippers, discharge of the treated water to Republic's Publicly Owned Treatment Works (POTW) via Republic's sewer system, an ordinance to prevent construction of wells in or near the contaminated groundwater plumes, and continued monitoring to determine the effectiveness of the remedy. The SSC Site achieved construction completion with the signing of the Preliminary Close Out Report on December 1, 1993.

The trigger for the Second Five-Year Review is the signing date, December 12, 1996, of the First Five-Year Review. The assessment of the second five-year review found the remedy was constructed in accordance with the requirements of the ROD and Consent Decree/Statement of Work (CD/SOW). No new or significant information was discovered during this review to indicate that the remedy is not functioning as designed. The immediate threats were addressed; thus exposure pathways that could result in unacceptable risks are being controlled by the remediation of the contaminated groundwater. Groundwater cleanup goals are projected for achievement within the next twenty years.

## **Five-Year Review Summary Form**

**SITE STATUS** NPL status: **Final Remediation status: Operating Multiple OUs?**  
**NO** Construction completion date: **09/20/1993** Has site been put into reuse? **NO**  
**Lead agency: State Author name: Candice McGhee Author title:**  
**Project Manager Author affiliation: Missouri Department of Natural Resources Review**  
**period: 08/01/2001 to 09/30/2002 Date(s) of site inspection: 10/17/2001 & 05/07/2002 Type**  
**of review:**

**Review number: Second**

**Triggering action:**

### **Previous Five-Year Review Report**

**Triggering action date (*from WasteLAN*): 12/12/1996 Due date (*five years after triggering action date*): 12/12/2001\*** ["OU" refers to operable unit.]

**\*\*** [Review period should correspond to the actual start and end dates of the Five-Year Review in WasteLAN.]



## **Five-Year Review Summary Form, continued**

### **Issues:**

The Site signs have an incorrect area code for Missouri Department of Natural Resource's telephone number.

With the possible sale of the SSC property again, the Agency noted a problem with the legal description as found in the Missouri Registry of Confirmed Abandoned or Uncontrolled Hazardous Waste Disposal Sites in Missouri (Registry).

### **Recommendations and Follow-up Actions:**

The site signs will be replaced with new signs containing the correct area code for the department's telephone number.

On June 6, 2002, the Registry Unit sent a "Modification of Information" to the Greene County Recorder's Office with a request to amend the legal description of the area placed on the Missouri Registry and filed on the deed. With the receipt of this change, the property owner, Missouri Remedial Action Corporation (MRAC), their consultant, U.S. Environmental Protection Agency (EPA), and other state agencies will be notified of the change.

### **Protectiveness Statement(s):**

All immediate threats at the site have been addressed. The remedy, a pump and treat system, is currently protective of human health and the environment and should still be protective after the groundwater cleanup goals are achieved in an additional twenty years.

### **Long Term Protectiveness:**

The long-term protectiveness of the remedial action (RA) will be verified by the continued reporting of chemical quality and hydraulic performance monitoring. This data will be used to evaluate the further potential migration of the trichloroethylene (TCE) plumes in the three aquifers beneath and downgradient of the site. Current chemical quality and hydraulic performance monitoring data indicate the plumes are stable, thus the remedy is functioning as required to achieve the groundwater cleanup goals.

### **Other Comments:**

There are no other comments to make at this time.

**Solid State Circuits  
Republic, Missouri  
Second Five-Year Review Report**

**I. Introduction**

The purpose of a five-year review is to determine whether the remedy at a site is protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, Five-Year Review reports identify issues found during the review, if any, and recommendations to address them.

The Missouri Department of Natural Resources is preparing this five-year review on behalf of the U.S. Environmental Protection Agency (EPA) pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

*If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The department interpreted this requirement further in the NCP; 40 CFR §300.430(f)(4)(ii), which states:

*If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

This is the second five-year review for the Solid State Circuit (SSC) Site. The triggering action for this statutory review was the EPA signing date, December 12, 1996, of the first five-year review. The five-year review is required because hazardous substances, pollutants, or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure.

The department conducted the five-year review of the remedial actions implemented at the SSC Site in Republic, Missouri. This review was conducted by the project manager (PM) for the entire site from September 2001 through September 2002. This report documents the results of the review.

## II. Site Chronology

**Table 1: Chronology of Site Events**

<b>Event</b>	<b>Date</b>
SSC manufactured printed circuit boards	1968 – 11/1973
TCE discovered in CW-1 during NSOC Survey	06/1982
Agencies conducted response activities	04/1983 – 03/1984
SSC site placed on the MO Registry	02/22/1985
DNR and PRPs conducted Removal Activities	03-11/1985
EPA signed Action Memorandum (AM)	4/5/1985
EPA conducted Removal Activities	4/5-10/31/1985
Multi-Site Cooperative Agreement between Agencies signed	10/01/1985
Final listing on EPA National Priorities Listing (NPL)	06/10/1986
Settlement Agreement & Consent Decree entered by Federal Court	11/20/1986
Stipulation & Joint Motion to Amend Settlement Agreement & Consent Decree entered by Federal Court	02/04/1988
SSC conducted Remedial Investigation/Feasibility Study (RI/FS)	12/1986-07/1989
ROD selecting the remedy is signed	09/27/1989
Administrative Order (AO) for RD & RA entered by Federal Court	06/20/1990
Consent Decree/Statement of Work (CD/SOW) was signed	07/25-11/23/1990
RD Pilot Remediation Program	09/01/1991-1/31/1992
MRAC's RD approved by department with EPA concurrence	12/22/1992
Implementation of Remedial Action (RA) Construction	01/11/1993
RA Construction completion date	09/20/1993
Preliminary Close Out Report received by department	12/01/1993
RA Certification Report received by department	05/1994
RA Operation & Maintenance (O&M) Plan approved	5/1994
ESD issued by MDNR with EPA concurrence, regarding modification of UFSB and DBR chemical quality and hydraulic performance monitoring	10/24/1996
First Five-Year Review approved	12/12/1996

## III. Background

### Physical Characteristics

The SSC Site, which was the former plant building, is located on the southeast corner of the intersection of Main and Elm Streets in Republic, Missouri (Figure 1). Republic is approximately 12 miles southwest of Springfield in Greene County, Missouri. The current population is approximately 7000 residents. The site is less than an acre in size and is enclosed within a six-foot high chain link fence. The SSC Site lies within the downtown area. The surrounding land use is urban. Single family dwellings exist to the east and two blocks to the west and south. Light industry and warehousing exists due west and south. A daycare facility is across the street, just north of the site.

## **Land and Resource Use**

Historically, the site has had a long and relatively unclear history. It has been used for industrial and manufacturing purposes by a number of businesses. Very little is known about the chemicals used onsite.

The SSC Site's former plant building was constructed prior to 1902 and was originally operated by a milling company. The building and basement extended the entire length of the block from Mill Street to Elm Street. It was one story except at the northern portion, which was four stories high (Figure 2). Sometime between 1902 and 1937, a cold refrigeration plant operated in the northern portion of the building. SSC was located in the northern portion of the building and operated from 1968 through November 1973, until they moved. Micrographics, Incorporated, a photographic-processing firm, operated until 1979.

In November 1979, the building's northern end was destroyed by fire. The damaged portion was demolished and the debris was pushed into the basement. The area was filled in to grade and became a vacant gravel lot.

The Crane Manufacturing Company of Crane, Missouri, owned the property until 1976. Mr. Nicholas Weinsaft purchased the property and owned it from 1976 until 1998. Mr. Lance McKnelley and Mr. Don Rogers purchased the property in 1998. Mr. McKnelley sold his portion to Mr. Rogers in 1999. Mr. and Mrs. Don Rogers are the current owners.

Between late 1998 and early 1999, the current owners conducted a cleanup of the property. The deteriorated portion was demolished and the debris was pushed into the basement. The area was filled in to grade and became part of the vacant lot. The remaining building was repaired.

Groundwater has always been the source of Republic's water supply system. There are three groundwater aquifers underlying the SSC Site. The groundwater in the aquifers appears to flow southward along Main Street. Republic's municipal (CW) water supply wells act as the mechanism to supply drinking water to the community. The only TCE contaminated municipal well, CW-1, was taken out of service sometime after July 1983. Currently, municipal wells CW-3, CW-4, and CW-5 supply Republic's water needs.

## **Site Geology and Hydrogeology**

The SSC Site lies on a broad upland setting with regional karst development. The rocks, Mississippian Age, are generally limestone with discontinuous beds of chert (Figure 3). There are three hydrogeological groundwater aquifers underlying the site: (1) the unconsolidated/fractured shallow bedrock (UFSB) zone, (2) the shallow unfractured bedrock (SBR) zone, and (3) the deep bedrock (DBR) zone.

The UFSB zone includes the residual unconsolidated soil materials and the upper fractured shallow limestone bedrock down to 75 feet below land surface (bls). Regional groundwater flow in the UFSB is generally to the south-southeast towards the Shuyler Creek drainage system.

The SBR zone includes the unfractured shallow limestone bedrock from 75 feet bls to the Northview Shale, an aquitard, at about 300 bls. Regional groundwater flow in the SBR is generally toward the south-southeast.

The DBR zone includes the deep limestone/dolomite/sandstone bedrock below the Northview Shale at depths greater than 300 bls. Regional groundwater flow in the DBR is generally toward the south-southeast.

### **History of Contamination**

SSC manufactured printed circuit boards at the site from 1968 through 1973 in the building's northern portion. Hazardous substances, such as volatile organic compounds (VOCs) and metals, were used in the manufacturing process. Solvents such as TCE were used in the cleaning process. Copper was used in the plating process. Due to a lack of records, a reliable estimate of the volume of hazardous substances used is not available.

Hazardous substances, such as TCE, were reportedly stored in the basement's sump pit near the basement well. Early sampling data indicated that improper management of spent TCE and copper-plating solutions caused the onsite and offsite contamination of surface and subsurface soils, air, utility conduits, and groundwater including Republic's drinking water supply. The elevated VOC concentrations in the subsurface soils and groundwater beneath the site indicated that an onsite release had occurred.

### **Initial Response**

The TCE contamination of Republic's CW-1, discovered in June 1982, was the cause of the original investigations and the subsequent remedial work done at the SSC Site (Figure 4). Between April 1983 and March 1984, the Agencies initiated response actions to identify contaminant sources and to further investigate the TCE occurrence in CW-1. The former SSC manufacturing plant was identified as one potential source of the TCE contamination.

On August 26, 1983, the department notified the property owner that the SSC Site was proposed for inclusion on the Registry. The listing was appealed and an agreement was reached. The SSC Site was placed on the Registry on February 22, 1985. With the completion of cleanup activities and the initiation of the long-term groundwater remediation and monitoring, the SSC Site's classification was reduced to a Class IV Site. Class IV indicates a site is properly closed but

requires continued management.

From March to November 1984, the department conducted response activities at the site. Extensive soil and groundwater sampling was done to delineate the onsite and offsite contamination. Contaminated onsite soils and debris were excavated from the basement area. Part of the contaminated material was shipped offsite, while the rest was stored onsite. This was due to Resource Conservation and Recovery Act (RCRA) disposal requirements. Three monitoring wells were installed. A wooden fence was installed for site security.

On April 5, 1985, an Action Memorandum (AM) was signed, which allowed EPA to conduct an immediate removal action from April to November 1985. Additional soil and groundwater sampling was done. Contaminated basement soils and debris were excavated. This and previously stockpiled contaminated materials were shipped offsite for disposal. The basement well was sealed and plugged. The installation of four offsite monitoring wells and two onsite recovery/monitoring wells occurred. The excavation was filled in to grade with clean materials. A chain-link fence replaced the wooden fence.

A Multi-Site Cooperative Agreement between the Agencies was signed on October 1, 1985. On October 7, 1985, the department assumed the long-term responsibility of the Site. The SSC Site was proposed for the National Priorities List (NPL) on October 15, 1984, and was listed on June 10, 1986.

MRAC, with department oversight, conducted a Remedial Investigation/Feasibility Study (RI/FS) from December 1985 until July 1989. Detailed monitoring, sampling, and analysis was conducted of onsite and offsite air, soil, surface water, utility water, and groundwater. The installation of a network of monitoring wells was completed. Numerous geophysical tests of wells and the local geology were performed. Data gathered was used in groundwater flow and airflow models to assess groundwater and airflow patterns and directions. CW-4 was construction and brought on-line. A pilot program was implemented to treat the contaminated groundwater.

The RI identified TCE contamination in the three groundwater aquifers both onsite and offsite. The FS evaluated four remedial alternatives. The remedy, a pump and treat system, was chosen to remediate the groundwater because the selected remedy addressed only the contaminated groundwater. Previous response actions had addressed the contaminated onsite soil. The Administrative Record (AR), which included the completed RI/FS and the Proposed Plan, was released to the public on August 14, 1989. A public meeting during the public comment period was held. After considering public comments, EPA, with department concurrence, selected the RA to be implemented at the site. The ROD with the chosen remedy was approved and signed on September 27, 1989.

### **Basis for Taking Action**

The following is a list of the hazardous substances which were found in samples up to, and including, the RI/FS. Over thirty hazardous substances were identified. Contamination,

predominantly TCE, was detected in various media including onsite and offsite soils, groundwater in the three aquifers, utility manholes, and the influent of the POTW wastewater.

**Onsite Groundwater:** Cadmium, Chromium, Iron, Mercury, Nickel, Zinc, Benzene, Carbon Tetrachloride, Chlorobenzene, Chloroethane, Chloroform, 1,1-Dichloroethane, 1,1-Dichloroethene, 1,3-Dichloropropylene, Ethylbenzene, Methylene Chloride, Tetrachloroethylene (PCE), Toluene, Trans-1,2-Dichloroethene, 1,1,1-Trichloroethane, 1,1,2-Trichloroethene, TCE, Vinyl Chloride, Acetone, 1,2-Dichloroethylene.

**Offsite Groundwater:** Lead, Magnesium, Manganese, 1,2-Dichloroethane, 1,2-Dichloropropane, Methyl Chloride, 2-Butanone (MEK), TCE, Carbon Disulfide.

**Republic's Drinking Water:** Copper, TCE

**Onsite Soil:** Benzene, 1,1-Dichloroethane, 1,1-Dichloroethene, Methylene Chloride, PCE, Trans-1,2-Dichloroethene, 1,1,1-Trichloroethane, 1,1,2-Trichloroethene, TCE, Vinyl Chloride.

**Offsite Soil:** Chloroform, Ethylbenzene, Toluene, TCE.

**Sewer:** Chloroform, 1,1-Dichloroethane, Ethylbenzene, Toluene, Trans-1,2-Dichloroethene, 1,1,1-Trichloroethane, TCE.

**SW Bell Telephone:** 1,1-Dichloroethane, 1,3-Dichloropropylene, Methylene Chloride, TCE.

Due to the wide variations in occurrence, concentrations, and toxicities found, seven indicator chemicals (Table 2) were chosen to use in the Human Health Risk Assessment and Ecological Risk Assessment. The carcinogens used were 1,1-dichloroethane, methylene chloride, TCE, and vinyl chloride. The noncarcinogens used were 1,1-dichloroethene, trans-1,2-dichloroethene, 1,1,1-trichloroethane.

At the time of both Risk Assessments, federal and state standards and criteria had been established to protect drinking water and fresh-water aquatic life. The federal standards (Maximum Contaminant Levels or MCLs) and/or Missouri Water Quality Standards existed for the 1,2-Dichloroethene, methylene chloride, 1,1,1-trichloroethane, TCE, and vinyl chloride. Safe Water Drinking Act Maximum Contaminant Level Goals (MCLGs) existed trans-1,2-Dichloroethene. No regulatory standards existed for 1,1-Dichloroethane and soils.

Based on the sampling results of the Human Health Risk Assessment, currently “no unacceptable” health risks were identified, but there is the potential for future unacceptable risks. Future risks could be a result of dermal contact or ingestion of groundwater in the aquifers beneath or in close proximity to the site. To prevent risk; the following assumptions were made: that contaminated groundwater at or near the Site will not be used for human consumption, that

**TABLE 2      APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS OR HEALTH GUIDELINES FOR  
INDICATOR CHEMICALS DETECTED AT THE REPUBLIC, MISSOURI SITE**

Chemical	GROUND-WATER			SURFACE WATER /POTW EFFLUENT				SOILS	
	Maximum Reported Concentration (mg/L)	MCL <sup>(1)</sup>	State of Missouri <sup>(5)</sup> Ground Water (VI, VII)	Maximum Reported Concentration (mg/L)	Aquatic Life <sup>(2)</sup>	State of Missouri Protection of Aquatic Life (I)	Fish Ingestion <sup>(3)</sup>	Maximum Reported Concentration (mg/kg)	Health Guideline
1,1-Dichloroethane	.890	NS	.00094	ND	NS	NS	NS	.450	NS <sup>6</sup>
1,1-Dichloroethene	1.0	.007	.007	ND	11.6	NS	0.0018	.086	NS <sup>6</sup>
1,2-Dichloroethene(Trans)	.880	.007 <sup>(4)</sup>	NS	ND	11.6	NS	0.0018	0.18	NS <sup>6</sup>
Methylene chloride	3.6	NS	.00019 <sup>(7)</sup>	0.15	0	NS	0	1.00	NS <sup>6</sup>
1,1,1-Trichloroethane	14.0	0.2	0.2	.0045	18.0	NS	41.8	.0023	NS <sup>6</sup>
Trichloroethene	290	.005	.005	.0061	21.9	NS	0.081	7.30	NS <sup>6</sup>
Vinyl chloride	.410	.002	.002	ND	NS	NS	0.002	0.15	NS <sup>6</sup>

**NOTE:**

Unit of Concentration for all federal and state standards is mg/L or mg/kg (ppm).

1 Primary Drinking Water Standard, Maximum Contaminant Level (40 CFR 141 and State Regulations State of Missouri 10 CSR 60-4,100)

2 Federal Water Quality Criteria for Protection of Fresh-Water Aquatic Life (USEPA, 1986b)

3 Federal Water Quality Criteria (FWQC) for Fish Ingestion (USEPA, 1986b)

4 Safe Water Drinking Act Maximum Contaminant Level Goal

5 State of Missouri Water Quality Standards

6 Health based risks associated with soils are presented in Section 6.0 and Appendix B

7 Missouri Water Quality Standard for halogenated methanes

ND = Not detected

NS = No standard established



private and public wells will not be drilled through or near the contaminant plumes, and that the remediation of the contaminated groundwater will continue as required.

Based on the results of the Ecological Risk Assessment, no adverse effects were identified for terrestrial or aquatic ecosystems. There was no indication of threatened or endangered wildlife species, but future risk by contaminated groundwater is also possible. The same assumptions were made.

#### **IV. Remedial Actions**

##### **Remedy Selection**

The ROD for the SSC Site was signed on September 27, 1989. The Remedial Action Objectives (RAOs) were developed as a result of data collected up to and during the RI to aid in the development and screening of remedial alternatives to be considered for the ROD. Because previous response actions had addressed the contaminated onsite soil, the remedy (a pump and treat system) selected addressed only the contaminated groundwater aquifers.

##### Source Control Response Objectives

- Prevent potential exposure to contaminated groundwater by containment and remediation;
- Protect uncontaminated groundwater for future use by preventing further migration of contaminated groundwater plumes;
- Restore contaminated groundwater for future use by reducing the TCE concentration to 5 parts per billion (ppb), the ARAR level for TCE groundwater contamination, or less;
- Protect the water supply for current and future use by preventing contamination of the groundwater pumped by the existing Republic municipal wells, which are uncontaminated.

##### Management of Migration Response Objectives

- Eliminate or minimize the threat posed to human health and the environment by preventing exposure to groundwater contaminants;
- Prevent further migration of groundwater contamination beyond its current extent;
- Restore contaminated groundwater to Federal and State applicable or relevant and appropriate requirements (ARARs), including drinking water standards, and to a level that is protective of human health and the environment within a reasonable period of time.

The major components of the remedy selected in the ROD include the following:

1. Extraction of the contaminated groundwater by using existing and new extraction wells from the three groundwater aquifers (Figure 5);
2. Onsite treatment of the extracted groundwater using the two existing air strippers (Figure 6);
3. Discharge of treated water to the City of Republic sewer system to receive further treatment at the Publicly Owned Treatment Works (POTW);
4. City ordinance to prevent construction of drinking wells in or near the contaminated groundwater plumes; and
5. Continued monitoring to determine the effectiveness of the remedy.

The major management components of the migration remedy selected in the ROD include:

1. The use of the pump and treat system to achieve groundwater cleanup levels;
2. A review and change, if necessary, of the planned location of drinking wells to prevent their construction within or near the contaminated groundwater plumes as defined in the city ordinance;
3. The ongoing chemical quality and hydraulic performance monitoring data collection as outlined;
4. The ongoing agency site inspections as outlined; and
5. To conduct five-year site reviews to assess site conditions, contaminant distribution, and any associated site hazards.

## **Remedy Implementation**

On December 13, 1989, EPA invited SSC to participate in negotiations for a settlement to conduct or finance the Remedial Design/Remedial Action (RD/RA) in accordance with the ROD. From December 1989 through July 1990, the Agencies and SSC negotiated the terms of the Consent Decree/Statement of Work (CD/SOW) for the RD/RA. Near the end of negotiations, the Agencies learned that SSC was contemplating a sale of its assets and the establishment of a trust fund to finance the remediation. This contingency was included in the CD/SOW. SSC signed the CD/SOW on July 2, 1990.

The department and SSC conducted a hydrogeologic survey in January and February 1990 using dye tracing to determine the existence of a hydrogeologic link between the TCE and copper plumes and the municipal wells, other existing wells, Cave Well, Shulyer and Terrell Creeks,

and Roberts Spring. The dye traces confirmed a link between the plumes and the wells, creeks, and spring. Because of the link, further contamination spread could endanger both human health and the environment.

SSC sold their assets and the money was placed in the SSC Trust Fund, with MRAC (Missouri Remedial Action Corporation), Incorporated, as the managers. A Trust Agreement was submitted by MRAC in February 1991 and was approved in October 1991. MRAC's management of the trust fund to date has been satisfactory. Regular review of the trust fund has projected that enough funds will exist to cover all future costs.

The CD/SOW for the site's cleanup was entered with the court on May 31, 1991. Before the Pilot Remediation Program began, it was determined that the stack heights of the two air strippers needed to be increased. While replacing the stacks, the mechanical components of the volatilization process were also changed. The Pilot Remediation Program began in September 1991. The program consisted of onsite treatment of the extracted groundwater using the air strippers. The Pilot Remediation Program was completed in December 1992. The effectiveness of removing TCE from the contaminated water was determined to be 98% to 99% effective.

The 75% RD package was received on May 4, 1992. It included the Pilot Remediation Program. MRAC was requested to submit, prior to the 100% RD package, the designs and specifications for the industrial computer system and sewer level sensors, the design specifications for the proposed Data Management System, and the results of the Air Modeling. On October 5, 1992, the Agencies received the 100% RD package. On December 22, 1992, the department approved, and EPA concurred with, the 100% RD Document Package for the groundwater cleanup alternative.

The approval of the 100% RD Document Package initiated the long term RA chemical quality and hydraulic performance monitoring programs. The site specific RA included the following components:

- Extraction of contaminated groundwater from the three hydrogeological systems – the UFSB, the SBR, and the DBR;
- Treatment of contaminated groundwater to include air stripping;
- Discharge of treated groundwater to the Republic sewer system for additional treatment at the POTW;
- Well construction restrictions to prohibit construction of water supply wells in zones of known groundwater contamination; and
- Continued groundwater monitoring.

Specific activities were required to assure the effective implementation of the RA. The primary activities included the installation of recovery wells in the USFB system, installation of

additional monitoring wells in the DBR, operation of the extraction, treatment, and discharge systems, ongoing chemical quality and hydraulic performance monitoring, and RA reporting.

RA construction began on January 11, 1993. Construction activities included the installation, testing, and sampling of onsite and offsite extraction and monitoring wells and their associated distribution system. CW-5 was constructed and put online, while CW-2 was taken offline. The completion of the construction connected all three hydrogeological zones to the site, thus allowing for the initiation of groundwater remediation via the pump and treat system. The treated water began discharging off-site via the sewers to the Republic POTW.

RA construction activities were completed on September 20, 1993. On October 29, 1993, the department sent EPA the Preliminary Close Out Report for the Long Term RA at the SSC Site. EPA sent the department a signed copy of the document on December 1, 1993.

Starting in July 1993, the chemical quality and hydraulic performance monitoring reporting changed from monthly to quarterly. In January 1994, water sampling for the municipal wells and their distribution systems changed to quarterly.

On March 29, 1994, the department conducted a pre-certification inspection of the remedy at the SSC Site as per the CD/SOW. The department's inspection determined that the RA construction activities were complete and that the remedy was operational and functional. Hydraulic control of the three hydrogeological aquifers had been achieved and maintained. EPA concurred with the department on May 19, 1994.

On May 31, 1994, the department received the RA Certification Report and As-Built Drawings for the SSC Site from MRAC as per the CD/SOW. On June 16, 1994, the department notified MRAC that the Agencies jointly had determined that the remedy for the SSC Site to be operational and functional as designed. It is expected that cleanup levels for all groundwater contaminants will be reached within approximately twenty more years. After groundwater cleanup levels have been met, the Agencies will issue a Final Close Out Report.

### **System Operations/Operation and Maintenance (O&M)**

MRAC is conducting, with the department and EPA oversight, long-term RA operation and maintenance (O&M) of the SSC Site according to the O&M plan that was jointly approved by the Agencies on June 16, 1994. The O&M plan set forth system procedures and equipment maintenance procedures to be implemented for effective day to day and long term operation of the selected remedy for the SSC Site. The primary activities associated with O&M include the following:

- Remedial system descriptions;
- Normal operating, inspection, and maintenance procedures and schedules;
- Potential operating problems and operation troubleshooting;

- Equipment monitoring and inspection requirements;
- Monitoring requirements to ensure appropriate operation and maintenance of the recovery and treatment systems;
- Contingent corrective action provisions; and
- Recordkeeping and reporting requirements to include personnel and safety.

After receiving EPA's concurrence, the department sent MRAC the Certification of Completion for the RA on September 16, 1994.

On September 23, 1994, the department received the final copy of the "Addendum Report to the RA Groundwater Monitoring and Management Plan (GMMP)." The GMMP contains the specific tasks required to evaluate the monitoring activities and site management as part of the groundwater remedial actions and their progress. This includes the requirements of the hydraulic control measures for the three aquifers, management of the extraction and monitoring wells, data collection and analysis, management practices, data reporting, and Quality Assurance/Quality Control (QA/QC) requirements.

The requirements for the SSC groundwater remedy are in accordance with the RD/RA CD/SOW that was entered into court on May 31, 1991. The CD/SOW defines the schedule for the submittal of the progress reports, which are submitted by MRAC for Agency approval. This schedule was initiated following the approval of the 100% RD Document Package. These reports document the chemical quality (Table 3) and hydraulic performance (Table 4) monitoring for the SSC Site. These reports and additional department split sampling are the basis of the long-term RA O&M of the SSC Site.

The O&M costs for the first five years dealt with the chemical quality and hydraulic performance monitoring of the chosen groundwater remedy for the SSC Site.

In addition to the CD/SOW requirements, the second five years of O&M costs have included the initiation of the ESD, which includes post-closure groundwater monitoring of CW-1 and the evaluation and implementation of the horizontal well – an innovative technology. In order to implement these actions, additional chemical quality monitoring information and data and hydraulic performance parameters were needed. This additional information and data plus the evaluation and implementation of the information and data increased the overall O&M cost for the second five years (Table 5).

TABLE 3

## TARGET COMPOUND LIST ANALYTES

<u>Analytical</u>	<u>Analyte Method</u>	<u>Reference</u>
VOLATILE ORGANICS		
Acetone	8240	SW-846
Benzene	8240	SW-846
Bromodichloromethane	8240	SW-846
Bromoform	8240	SW-846
Bromomethane	8240	SW-846
2-Butanone	8240	SW-846
Carbon Disulfide	8240	SW-846
Carbon Tetrachloride	8240	SW-846
Chlorobenzene	8240	SW-846
Chlorodibromomethane	8240	SW-846
Chloroethane	8240	SW-846
2-Chloroethyl Vinyl Ether	8240	SW-846
Chloroform	8240	SW-846
Chloromethane	8240	SW-846
1,1-Dichloroethane	8240	SW-846
1,2-Dichloroethane	8240	SW-846
1,1-Dichloroethene	8240	SW-846
1,2-Dichloroethene	8240	SW-846
(total)		
1,2-Dichloropropane	8240	SW-846
cis-1,3-Dichloropropene	8240	SW-846
trans-1,3-Dichloropropene	8240	SW-846
Ethylbenzene	8240	SW-846
2-Hexanone	8240	SW-846
Methylene Chloride	8240	SW-846
4-Methyl-2-Pentanone	8240	SW-846
Styrene	8240	SW-846
1,1,2,2-Tetrachloroethane	8240	SW-846
Tetrachloroethene	8240	SW-846
Toluene	8240	SW-846
1,1,1-Trichloroethane	8240	SW-846
1,1,2-Trichloroethane	8240	SW-846
Trichloroethene	8240	SW-846
Vinyl Acetate	8240	SW-846
Vinyl Chloride	8240	SW-846
Xylenes (total)	8240	SW-846
METALS		
Chromium	6010	SW-846
Copper	6010	SW-846
Lead	7421	SW-846
Mercury	7470	SW-846
Zinc	6010	SW-846
Nickel	7520	SW-846

TABLE 4

## SUMMARY OF HYDRAULIC MONITORING PROGRAM

## HYDRAULIC MONITORING - GROUNDWATER LEVELS

<u>Network Wells</u>	<u>Recording/ Measuring Interval</u>	<u>Method</u>
UFSB Wells: SSC-11, 12, 24, 26 27, 29, 30, 31	2 hours	Digital data logger
SBR Wells: REM-2, SSC-1A, 3A, 4A, 6C, AbCW-4A	2 hours	Digital data logger
DBR Wells: REM-1, CW-1, SSC-1B, 2B 3B, 4B, 6B, AbCW-4B	2 hours	Digital data logger
Municipal Wells: CW-2, 3, 4, 5(1)	2 hours	Digital data logger
All Wells:	Quarterly	Manual measurement

## HYDRAULIC MONITORING - GROUNDWATER PUMPAGE

UFSB Wells: SSC-29, 30, 31	2 hours	Digital data logger
SBR Wells: REM-2, SSC-6C	2 hours	Digital data logger
DBR Wells: REM-1, CW-1	2 hours	Digital data logger
Municipal Wells: CW-2, 3, 4, 5(1)	Quarterly	City municipal pumpage data

Notes:

(1) When constructed

**Table 5: Annual System Operations/O&M Costs**

<b>Dates</b>		<b>Total Cost rounded to nearest \$1,000</b>
<b>From</b>	<b>To</b>	
June 1, 1996	December 31, 1996	\$106,000
January 1, 1997	December 31, 1997	\$326,000
January 1, 1998	December 31, 1998	\$709,000
January 1, 1999	December 31, 1999	\$425,000
January 1, 2000	December 31, 2000	\$369,000
January 1, 2001	May 31, 2001	\$187,000

## **V. Progress Since the Last Review**

The First Five-Year Performance Review Report was completed in September 1996. The following is the “Protectiveness Statement” from that First Five-Year Review:

*Thus the response actions taken by MRAC with oversight by DNR and EPA, together with the long-term maintenance and monitoring by MRAC continues to protect public health, welfare, and the environment from the remaining TCE contamination at the Solid State Circuits, Republic, Missouri site. No new or significant information was discovered during this review to indicate that the remedy does not continue to be protective.*

Based on the information, data, and documents collected and reviewed for the First Five-Year Review, no additional recommendations or follow-up actions were suggested. Also no prior unresolved issues existed for the SSC Site. The response actions of taking Republic’s Municipal Well CW-1 out-of-service, the soil removal, and the ongoing pump and treat system which employs air stripping to remove TCE contamination from the three groundwater aquifers was deemed operating as designed in the First Five-Year Review. Thus the department, with EPA concurrence, determined that the chosen groundwater remedy for the SSC Site was still protective of human health and the environment.

### **Actions Taken Since the Last Five-Year Review:**

As per the CD/SOW, the required chemical quality and hydraulic performance monitoring continues. Along with the required sampling criteria, additional samples were collected and analyzed for specific activities conducted outside the required CD/SOW criteria, but in association with the innovation technology and ESD evaluations.

The chemical quality samples collected use the following criteria:

- Semi-annual and annual groundwater chemical quality monitoring of operating remedial extraction and selected monitoring wells;



- Post-closure groundwater chemical quality monitoring of closed extraction well(s); and
- Monthly and quarterly treatment system monitoring of fluids from the onsite air stripper treatment system, fluids discharged to Republic's sanitary sewer system, and fluids from Republic's POTW influent and effluent.

The samples were either analyzed for TCE only or for Target Compound List (TCL) VOCs in accordance with the CD/SOW monitoring requirements.

This data was used to determine if the:

- Operation of the remedial treatment system was done in accordance with the CD/SOW requirements;
- USFB maintained hydraulic control as seen at the Broad Street sewer location;
- Operational efficiencies of dual air strippers maintained the projected performance criteria;
- Sewer discharge limits were maintained; and
- The data was also used to calculate the estimated volume of TCE removed since the RI

The hydraulic performance data collected use the following criteria:

- Continuous digital groundwater level monitoring with a two-hour recording interval at all designated remedial extraction and monitoring network wells;
- Quarterly manual groundwater level monitoring at all remedial extraction and monitoring wells;
- Continuous digital pumpage monitoring with a two-hour recording interval at all designated remedial extraction and monitoring network wells;
- Manual totalizer readings for all remedial extraction wells collected three times each week;
- Quarterly manual recordings of Republic's municipal well pumpage to the extent possible; and
- Monitoring remedial fluid discharge flow rates into Republic's sanitary sewer system.

The hydraulic performance monitoring data was used to determine if the:

- Operation of the remedy continues to effectively capture and maintain control of the TCE contaminant plumes in the three hydrogeologic aquifers;

- Rolling Annual Average (RAA) performance parameters and the specific operational criteria as defined for each hydraulic system is maintained;
- Remedial discharge rate to Republic's sewer system has not exceeded specific performance criteria; and
- Total remedial system downtime has not exceeded the specific performance criteria.

Based on post-RI chemical sampling and hydraulic performance results, MRAC petitioned the Agencies to modify the chemical quality and hydraulic performance monitoring of the UFSB and the DBR, and post-closure monitoring of CW-1 in accordance to the CD/SOW. The Agencies granted the petition. Since this action was not a major change to the ROD and CD/SOW, this modification was deemed an ESD. The ESD was granted on October 24, 1996.

This action initiated post-closure monitoring of CW-1. Post-closure-monitoring of CW-1 includes the collection of semi-annual samples for analysis of TCL VOCs. This ongoing monitoring, which has been conducted in two-year increments, indicates MCLs have not been exceeded for TCL VOC parameters, especially TCE.

In spring 1997, shortly after MRAC's submittal of their Five-Year Review, MRAC suggested exploring the use of innovative technologies to assist in the cleanup of the TCE contaminated groundwater. On July 15, 1997, MRAC presented to the Agencies their proposal to use a horizontal well (innovative technology) to assist in the remediation of TCE found in the UFSB. If the horizontal well works as projected, it would enhance the groundwater remedy and possibly reduce project costs.

Along with the chemical quality and hydraulic performance monitoring data collected in 1996, additional chemical quality and hydraulic performance monitoring data was collected and geophysical testing and dye tracings were conducted. This data and information was used to evaluate the implementation of a Pilot Project for the Horizontal Well. Upon review, the Agencies approved the construction of the Horizontal Well.

The installation of the horizontal well and associated piping and vaults began on April 20, 1998. The field activities associated with the well installation and associated construction work was completed in two phases. The following activities were completed: drilling, installation, and development of the horizontal well; excavation and construction of vaults, piping trenches, piping connections, and installation of electrical and instrumentation wiring. Construction field activities were completed in mid-September 1998. Multiple video camera surveys of the well casing and screen were attempted in September 1998, January and April 1999. MRAC's consultant and state personnel oversaw all aspects of the field activities. Field activities were completed in April 1999.

Based on testing information gathered, injection pilot testing was the method chosen to determine the usefulness of the horizontal well as an injection system into the UFSB. Upon approval, dye testing, a 500-gallon slug injection test, a 1,500-gallon slug injection test, and a

3,000-gallon slug injection test were done. Results indicated that a longer-term injection test would be necessary to fully understand and define project cost reduction benefits, impact from injection on chemical flushing within the UFSB, and impact on hydraulic control.

## **VI. Five-Year Review Process**

### **Community Involvement**

After the first Five-Year Review for the SSC Site was completed, the department hosted an Availability Session at the Public Library in Republic, Missouri, on February 20, 1997. The Availability Session was to share information about the Five-Year Review and to share information on how to make a public comment about the document. Three display advertisements were run in the newspaper and a sign was hung in the library announcing the meeting. The ads also announced that the Information Repository had been updated and that the Five-Year Review was in the repository at the library. No citizens came to the meeting or commented on the document.

The department hosted a second Availability Session that year on November 11, 1997, to explain the proposed horizontal well that was going to be installed. Three ads were run in the newspaper and a sign was hung at the library. At that public meeting only one local person attended. Based on current public acceptance of the remedy for the SSC Site, there has been no further community outreach.

### **Document Review**

This five-year review consisted of a review of relevant documents including the early decision documents and O & M records (See Attachment). Applicable groundwater cleanup standards, as listed in the 1989 Record of Decision, were also reviewed.

### **Data Review**

Groundwater monitoring and sampling began for the SSC Site in June 1982. Between June 1982 and April 1983, data was collected for the three Republic municipal wells. When sampling confirmed that municipal well CW-1 was the only municipal well contaminated with TCE, sampling was expanded to determine the source area(s). In general, most contaminants were detected at their highest levels during the early removal/remedial history of the site (1982 to 1990). The drop in TCE concentrations probably was the result of the removal activities eliminating significant source materials.

The requirements for the SSC groundwater remedy are in accordance with the RD/RA CD/SOW entered into court on May 31, 1991. One requirement of the CD/SOW is the continued reporting of the ongoing chemical quality and hydraulic performance monitoring at the site. The CD/SOW outlines the schedule for the submittal of the progress reports, which are submitted by MRAC for Agency approval. This schedule was initiated following the approval of the 100% RD Document Package. Hydraulic performance reports have been submitted to the Agencies on a quarterly basis since the first full quarter following approval. Annual reports began in the third

year after approval. Five-year performance reports follow every fifth year anniversary of the court entry date of the CD/SOW. The reports and additional Agency split sampling are the basis of the First and Second (current) Five-Year Review Reports.

In 1995, water sampling was reduced to biannually for the Republic municipal wells and the distribution system. Chemical quality monitoring reporting was reduced to semi-annual, while the hydraulic performance monitoring reporting for the monitoring wells remained quarterly.

The First Five-Year Performance Review Report was completed in September 1996. During this review, chemical quality and hydraulic performance monitoring was reviewed and compared to the criteria outlined in the ROD and CD/SOW to determine if the chosen groundwater remedy was functioning as designed and was protective.

As per the CD/SOW, annual collection and analysis of the TCL VOCs and site specific metals was done at designated operating extraction wells, and annual sampling and analysis of TCE was done at designated monitoring wells and municipal wells. TCE reporting limits, MCLs, shall be 5 parts per billion (ppb) for all sample locations except for the POTW effluent, which will be 2 ppb. The department, with EPA concurrence, determined that the chosen groundwater remedy for the SSC Site was still protective of human health and the environment.

The Second (current) Five-Year Performance Review Report summarizes the progress of the RA chemical quality and hydraulic performance monitoring of the remedy for the years June 1996 through May 2001. During this five-year review period, chemical quality and hydraulic performance monitoring was reviewed and compared following the same criteria as the First Five-Year Review. Additional chemical quality samples and hydraulic performance parameters were collected for the ESD and the horizontal well.

### **Site Inspection**

Site inspections were conducted on October 17, 2001, and May 7, 2002, by the PM. The October 17, 2001, site inspection was combined with the annual groundwater sampling.

The purpose of the inspections was to assess the protectiveness of the existing groundwater remedy, including all monitoring and extraction wells, onsite air strippers, three remaining municipal wells, POTW, Cave Well, and Roberts Spring. No significant issues regarding the groundwater remediation were noted. The site signs still had the incorrect area code for the agency's telephone number. The current property owner had done improvements to the existing building. A post-site visit to the County Planning Office in Springfield, Missouri, was done to verify and obtain a copy of the site's legal deed description. As noted before the inspection, more than one description for the portion listed on the Registry existed.

### **Interviews**

During the last five years, public interest in the SSC Site appears to have waned. This was evident during the last two availability sessions, where there was no public participation. The first meeting in February 1997 saw no public attendance and the second meeting saw one person

attend. For this reason, interviews were not conducted during this five-year review.

## **Administrative Components**

On August 1, 2001, the department sent a formal notification to all interested parties regarding the Second Five-Year Review. The notification initiated the review and projected completion date. The targeted completion date was extended from May 31, 2002, to September 30, 2002.

## **VII. Technical Assessment**

### **Question A: Is the remedy functioning as intended by the decision documents?**

Yes. The review of documents, ARARs, risk assumptions, and the results of the two site inspections indicate the remedy is functioning as outlined in the ROD, as designed and constructed under the CD/SOW, and as modified by the ESD. The remedy for the SSC Site only addresses the contamination of the groundwater aquifers. The remedy, a pump and treat system, has achieved the RAOs to minimize the threat posed to human health and the environment and to prevent the further migration of groundwater contamination beyond its current extent. The continued operation of the remedy is working towards restoring the contaminated groundwater to Federal and State ARARs, including drinking water standards.

### **Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) established at the time of remedy selection still valid?**

Yes. Since there have been no changes in the physical conditions of the SSC Site since the time of the remedy selection, the exposure assumptions, toxicity data, cleanup levels, and RAOs that would affect the protectiveness of the chosen remedy are still valid.

### **Changes in Standards and To Be Considereds (TBCs)**

As the remedy progresses towards restoring the three groundwater aquifers to pre-contamination conditions, the same ARARs, especially for TCE, that were valid when the remedy was chosen will still need to be met when the groundwater is considered fully remediated. ARARs that still need to be met at this time and have been evaluated include the Safe Drinking Water Act (SDWA) (40 CFR 141.11-141.16) from which many of the groundwater cleanup levels were derived –[MCLs and MCL Goals (MCLGs)] and ARARs relating to post-closure monitoring. There have been no changes in these ARARs and no new standards or TBCs affecting the protectiveness of the remedy.

### **Changes in Exposure Pathways, Toxicity, and Other Contaminant Characteristics**

The exposure assumptions used to develop the Human Health Risk Assessment included both current and potential future exposures. There have been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessment. These assumptions are considered to be conservative and reasonable in evaluating risk and developing risk-based cleanup levels. No change in assumptions, or cleanup levels developed from them is warranted.

There has been no change to the standardized risk assessment methodology that could affect the protectiveness of the remedy. The remedy is progressing as expected and it is expected that all groundwater cleanup levels will be met within approximately twenty years.

**Question C: Has any other information come to light that could call into question the protectiveness of the remedy?**

No ecological targets were identified during the baseline risk assessment and none were identified during the five-year review, therefore monitoring of ecological targets is not necessary. Even though this monitoring is not necessary, annual VOC sampling, especially of TCE, is recommended at Roberts Spring. Besides being a possible ecological target, Roberts Spring is an excellent monitoring point to verify continued chemical quality and hydraulic performance control of the shallow aquifers. No weather-related events have affected the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

**Technical Assessment Summary**

According to the data review and site inspections, the remedy is functioning as outlined in the ROD, designed and constructed under the CD/SOW, and as modified by the ESD. There have been no changes in the physical conditions of the site that would affect the protectiveness of the chosen remedy. As the remedy progresses, the pump and treat system will restore the contaminated groundwater to Federal and State ARARs. There have been no changes in the toxicity factors for the contaminants of concern that were used in the baseline risk assessment, and there have been no changes to the standardized risk assessment methodology that could affect the protectiveness of the remedy. There is no other information that calls into question the protectiveness of the remedy.

**VIII. Issues**

Of the four issues found and evaluated, two have no direct affect on remedy and two do. The issues of incorrect site signs and the Registry legal description are administrative issues. The pump and treat system and the horizontal well in the UFSB are an integral part of the remedy. The remediation of the TCE contaminated groundwater via the pump and treat system is and should continue to be protective. The treated water is discharged off-site to the City of Republic's POTW via the sewer system. MRAC, with the Agencies approval, is exploring the full-scale implementation of a horizontal well to assist in the operation of the chosen remedy.

**Table 6: Issues**

<b>Issues</b>	<b>Affects Current Protectiveness (Y/N)</b>	<b>Affects Future Protectiveness (Y/N)</b>
Incorrect area code on Site signs	N	N

Site legal description as found in the Missouri <i>Registry</i> .	N	N
Pump and Treat System	Y	Y
Horizontal Well in the UFSB	Y	Y

## **IX. Recommendations and Follow-up Actions**

Of the four issues addressed above, two are of a short-term nature. The replacing of the site's current signs with new signs containing the correct area code is easily rectified. The site's legal description as outlined in the Missouri Registry and placed as a deed notice on the Deed will soon be corrected and all parties involved will be notified.

The Pump and Treat System for the SSC Site as outlined in the CD/SOW is currently, and should continue to be, protective of human health and the environment. If the full-scale implementation of the horizontal well in the UFSB occurs, it too should be protective. At this time, there are no recommendations for improvements to the current site operations, activities, remedy, or conditions at the SSC Site.

## **X. Protectiveness Statement(s)**

The remedy at the SSC Site is, and should remain, protective of human health and the environment. The remedy, a pump and treat system, will continue to operate for another twenty years or upon attainment of the groundwater cleanup goals. The immediate threats were addressed; thus exposure pathways that could result in unacceptable risks are being controlled by the remediation of the contaminated groundwater. All threats at the site have been addressed through onsite soil removal, the pump and treat system, the installation of fencing and warning signs, and the implementation of institutional controls.

The long-term protectiveness of the RA has been and will be verified by continued annual groundwater chemical quality monitoring and quarterly hydraulic performance monitoring of the three aquifers. The groundwater chemical quality and hydraulic performance monitoring of the three aquifers follow specific criteria as found in the CD/SOW. Groundwater chemical quality monitoring is currently reported annually, while the hydraulic performance monitoring data is reported quarterly.

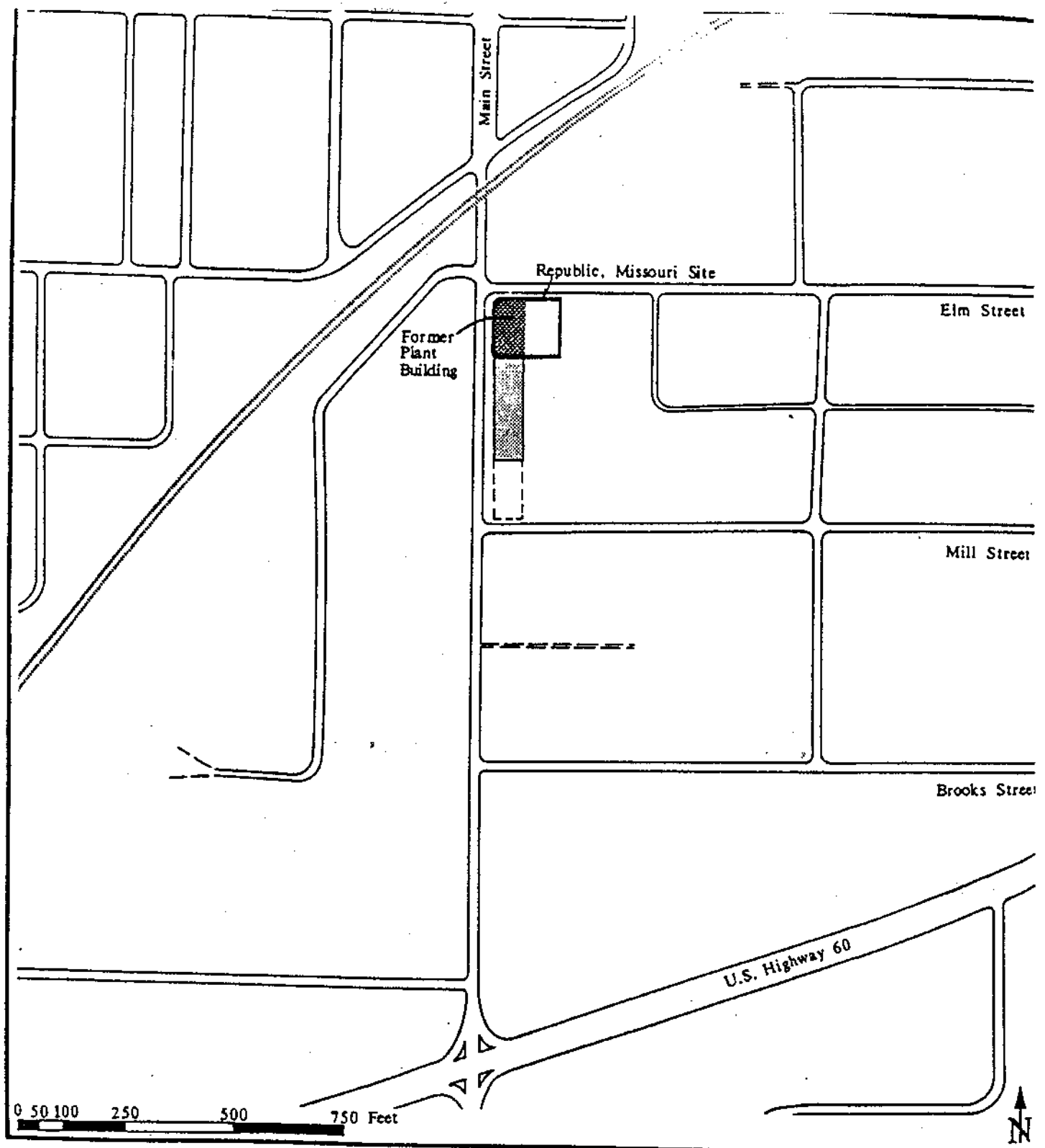
## **XI. Next Review**

The next five-year review for the Solid State Circuits site is required by September 2007, five years from the date of this review.

## **Attachments**



## Figures



## LOCATION OF THE REPUBLIC, MISSOURI SITE

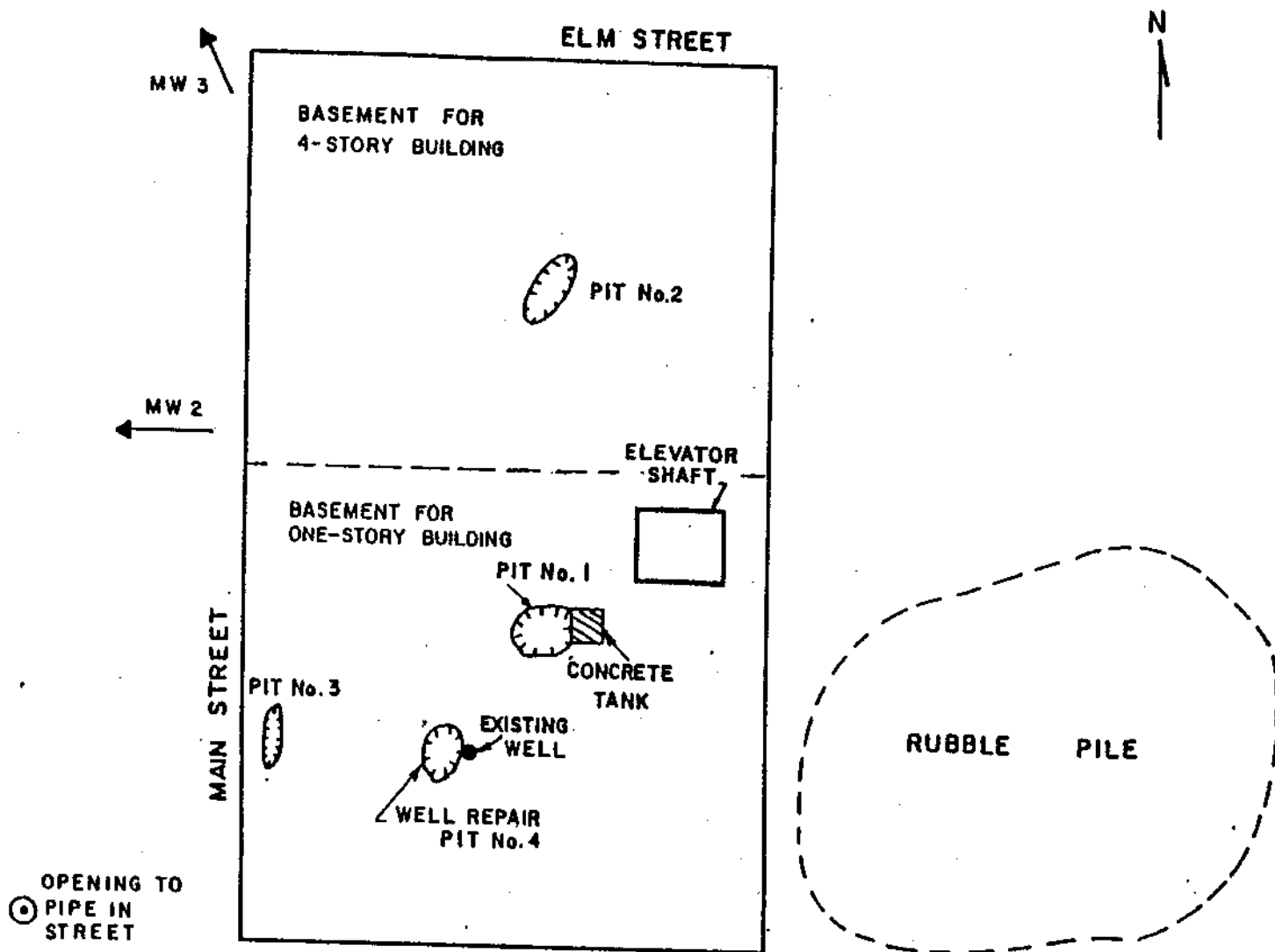
- Former Plant Building
  - Existing One-Story Building
  - Former Extent of One-Story Building
- Prepared for: Solid State Circuits, Inc.

203B/23MAY89S

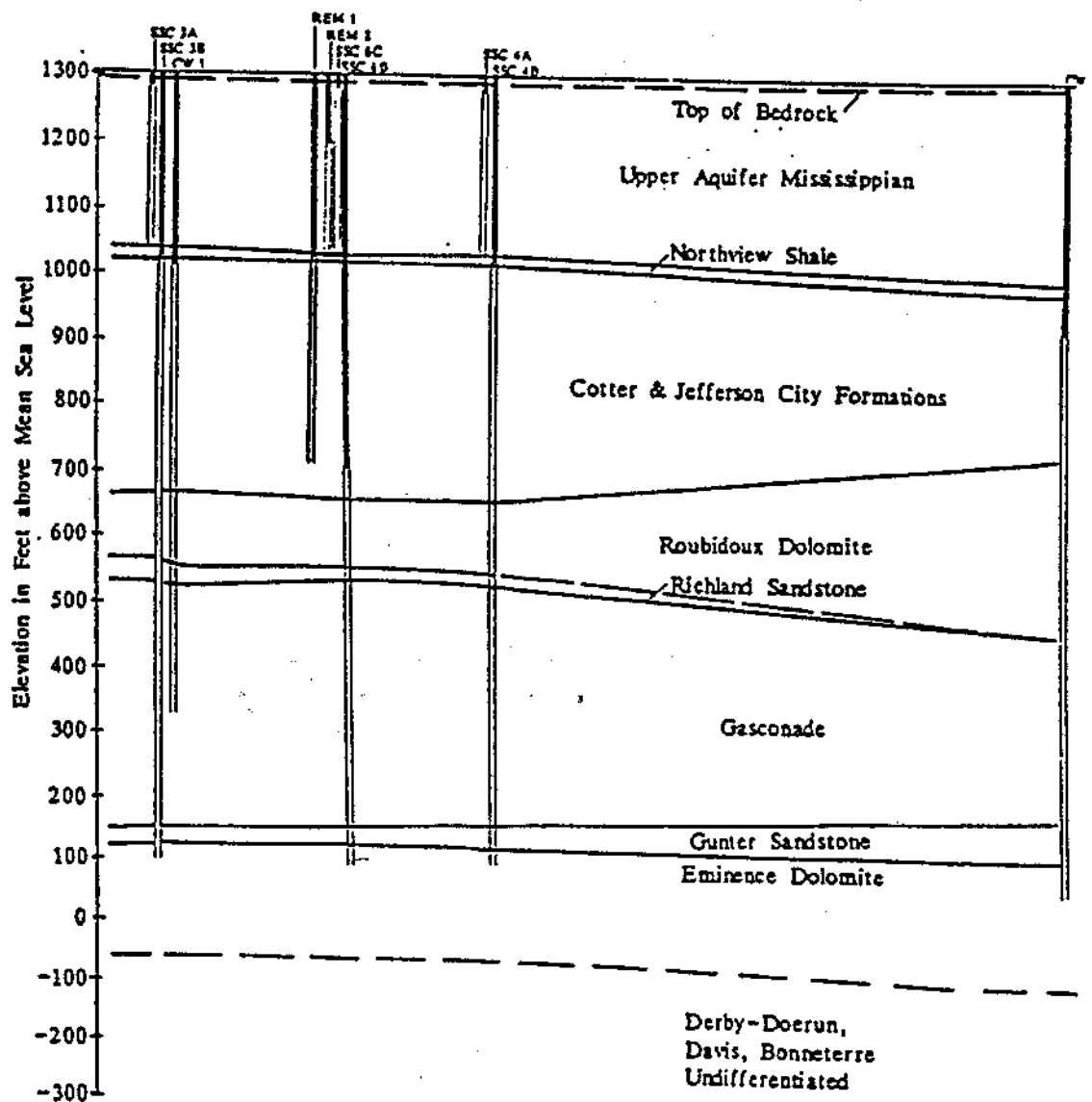
Project Manager: Steven D. Chatman

Geraghty & Miller, Inc.

FIGURE 1



**FIGURE 2**  
**Site Detail Map**



## BEDROCK GEOLOGIC CROSS SECTION

| Casing  
|| Open Borehole

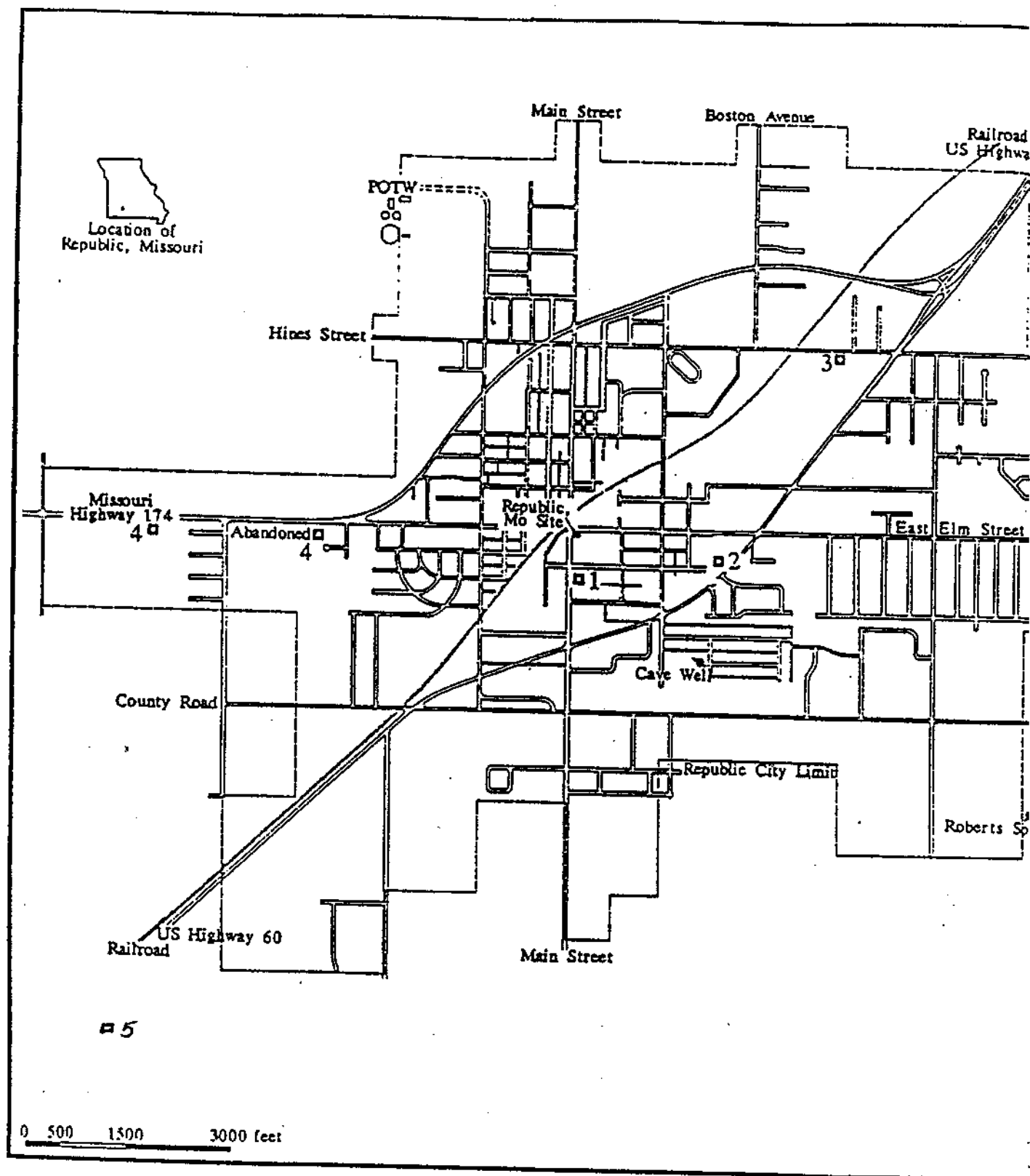
Prepared for: Solid State Circuits, Inc.

203B/23MAY89S

Project Manager: Steven D. Cha

Geraghty & Miller, Inc.

FIGURE 3



# MAP OF REPUBLIC, MISSOURI

FIGURE 4

Map of Municipal Wells, POTW, Cave Well, & Roberts Spring

- CW - Municipal Well
- Cave Well
- ▲ Roberts Spring

Prepared for: Solid State Circuits, Inc.

203B/23MAY89S

Project Manager: Steven D. Charn

Geraghty & Miller, Inc.



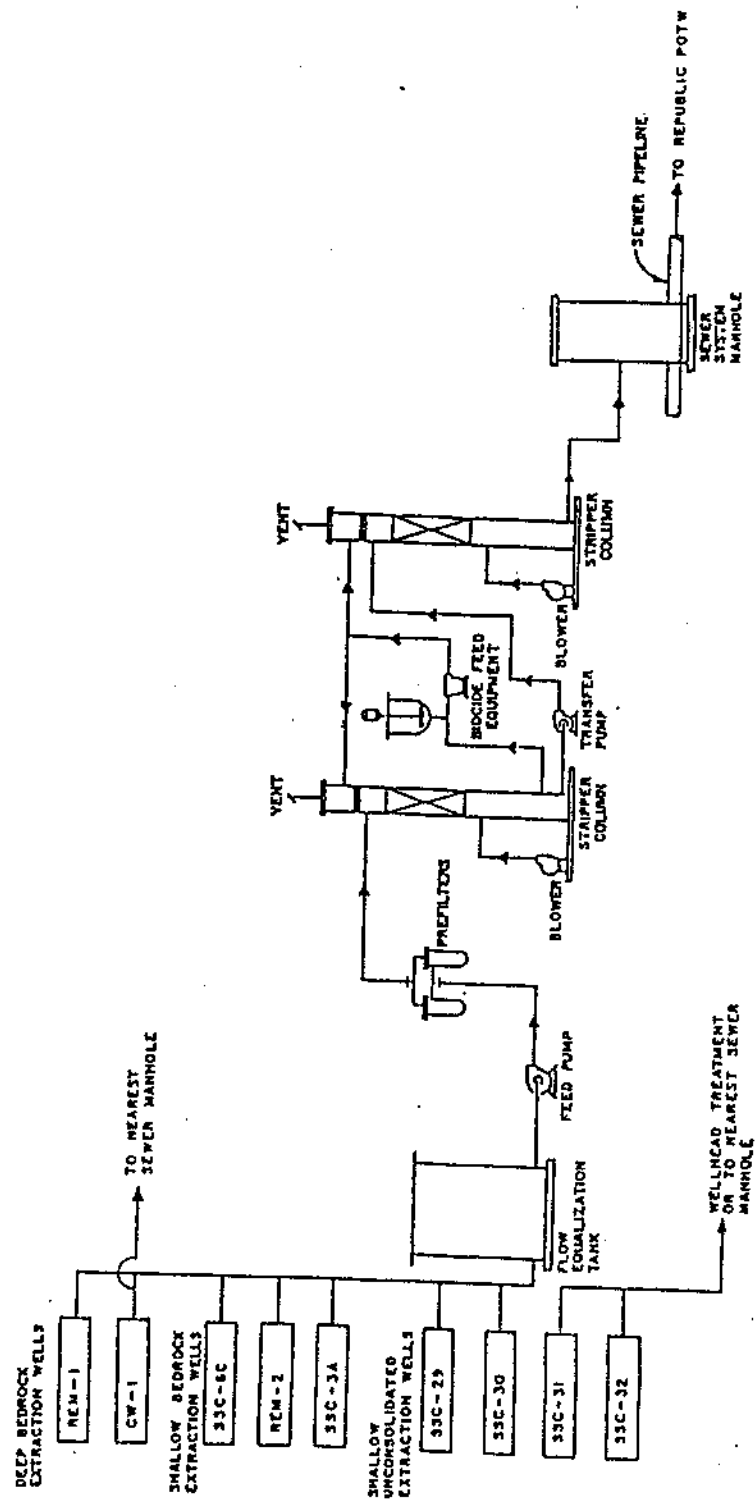


FIGURE 6  
Schematic of Pump and Treat System

ALTERNATIVE II  
PROCESS FLOW DIAGRAM





## **List of Documents Reviewed**

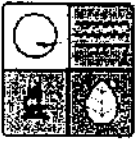
The following documents were reviewed in completing the five-year review:

- Record of Decision (ROD) including all attachments.
- Consent Decree/Statement of Work (CD/SOW).
- Remedial Action (RA) construction documents.
- Remedial Action (RA) Operation and Maintenance (O & M) Plan.
- 100% Remedial Design (RD) Document Package.
- Quarterly Hydraulic Performance Control Reports.
- Annual Reports.
- First Five-Year Review Report.
- Other guidance and regulations to determine if any new applicable or relevant and appropriate requirements (ARARs) relating to the protectiveness of the response actions that have been developed.

## **Appendix**



Re: Solid State Circuits - Candice McGhee/HWP/DEQ/MODNR



Peter Bachle

To: Candice McGhee/HWP/DEQ/MODNR@MODNR

CC:

08/27/2002 08:38 AM

Subject: Re: Solid State Circuits 

Candy,

Everything looks alright to me.

Peter B.